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Influenza vaccination of future healthcare workers: A cross-sectional study of uptake, knowledge and attitudes

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ABSTRACT

Promotional campaigns recommend immunisation against influenza in healthcare workers (HCWs) but the uptake in this group remains low. We conducted a survey study during the 2008–2009 influenza vaccination period amongst future HCWs to quantify uptake and identify barriers to immunisation. Overall uptake was 8.0% (95% CI 5.9–10.8%), which is lower than the uptake amongst current HCWs (13.4%) and short of current government targets (75%). Knowledge about influenza was good but insufficient to encourage HCWs to get vaccinated. Promotional campaigns are needed that emphasise the role of vaccination in personal and patient protection.

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1. Introduction

Influenza is a major health problem and contributes a significant burden to health services in the UK [1–3]. In 2008–2009 in England and Wales, influenza and its complications contributed 36,700, mostly elderly, additional deaths to winter mortality figures [4]. Vaccination is recommended to directly reduce morbidity and mortality attributable to influenza, particularly in high-risk and vulnerable individuals [5,6]. In 2000, the Chief Medical Officer extended this recommendation to include vaccination for all healthcare staff “directly involved in patient care” to reduce the risk of occupational infection and to prevent nosocomial transmission to vulnerable patients [7–9]. Healthcare workers (HCWs) are doubly at risk of infection since they are exposed in the community and also at work [9]. Given that up to 25% of non-immunised HCWs contract influenza in the winter months [9], vaccination of HCWs could also reduce staff absence during influenza outbreaks, allowing continued delivery of optimum healthcare [10]. Pandemic influenza is a particular concern and vaccinating HCWs should help

to increase herd immunity, thereby potentially reducing influenza outbreaks [11].

Although vaccination is recommended, coverage amongst HCWs is low, with reported uptake of 13–40% [7,12,13]. A systematic review reported that the reasons often cited for low uptake were: fear of vaccine side effects, fear that influenza would be caused by the vaccine, aversion to injections, lack of knowledge about the usefulness of the vaccine or its availability, forgetfulness or time constraints, and misperception of the risk of contracting influenza [13]. Further understanding of factors that influence HCWs' vaccine uptake may be crucial to inform targeted implementation strategies needed for improving the success of promotion campaigns to increase influenza vaccine uptake.

Knowledge about attitudes towards influenza vaccination and the current vaccination uptake amongst HCWs is necessary for successful implementation of current recommendations. Most studies, however, have compared newly recruited or established HCWs [14,15]. Few studies have focused specifically on the uptake of influenza vaccination in those training to become doctors, nurses, physiotherapists and dentists, considered to be ‘future’ HCWs. One study reported uptake of 5.2% in healthcare students in Iran [14]. Our study is the first to assess influenza vaccine uptake in future HCWs in a Western country. The aims of this study were to determine the uptake of influenza vaccination in future HCWs and compare this with the uptake of current HCWs, and to examine future HCWs' knowledge about recommended occu-

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pational influenza vaccination and attitudes towards influenza vaccination.

2. Methods

2.1. Study design and setting

We conducted a cross-sectional survey among future HCWs for the season 2008–2009 at the College of Medical and Dental Sciences at the University of Birmingham, West Midlands, UK.

2.2. Study population

We selected participants to represent a population of future HCWs who have direct patient contact and are therefore eligible to receive the influenza vaccination. Undergraduates were chosen from every year of medicine, nursing, physiotherapy and dentistry and were further classified into 'pre-clinical' and 'clinical' groups depending on their exposure to patients. The first two years of medical and dental students, without clinical exposure were classified as the 'pre-clinical' group. Physiotherapy and nursing students have clinical exposure from the start of their courses whereas medical and dental students do so from the third year and so were allocated to the 'clinical group'.

2.3. Materials

We designed a structured, self-administered 23 item questionnaire which included fixed questions with closed answers and attitude statements (see [Appendix A](#)). Information concerning demographic characteristics (age, sex, course) was also collected. Questions 1 and 2 required a yes/no response to vaccination status. Questions 3–5, designed to assess knowledge of influenza, required true or false responses. Correct answers scored 1 point and incorrect answers were scored as 0. The dimensions of the Health Belief Model [16] have contributed to the understanding of preventative health belief behaviours. We therefore developed the attitude section of our survey based on these dimensions. Questions 6–18 were designed to assess attitudes towards vaccination and influenza, with Likert scale scores ranging from 1 (strongly disagree) to 5 (strongly agree). Total scores were summed for each subscale. In line with the Health Belief Model [16], the questions were grouped into the following subscales: beliefs (11, 17, 18); severity (6, 8, 14); susceptibility (7, 13, 16); barriers (9, 12) and benefits (10, 15). Strongly positive answers scored 5 and strongly negative answers scored 1, depending on the favourability of the question. For example, question 8 "I cannot die from 'flu'": 'strongly agree' received 1 point and 'strongly disagree' received 5 points. For questions that had a favourable outcome or were factually correct, such as question 6, "the 'flu' is a potentially fatal illness", reverse scoring was applied: 'strongly agree' scored 5 points and 'strongly disagree' scored 1 point. We pre-tested and piloted the questionnaire in order to refine its content and design.

2.4. Data collection

The College of Medical & Dental Sciences, University of Birmingham, UK, granted approval to conduct the study. Predetermined representative sample groups were allocated by the medical school to ensure that students were not answering multiple questionnaires. Questionnaires were distributed during the start of lectures and completed anonymously. Returned completed questionnaires were regarded as representing informed consent. Data collection was carried out throughout January 2009 to April 2009, following the 2008–2009 influenza vaccination campaign.

2.5. Data analysis

Results were categorised by sex, and by medical course. The results were also classified into pre-clinical and clinical groups in order to evaluate any differences between students who had more practical medical experience and those who were in the later stages of their course. Eligibility and uptake were compared across gender, course and level of experience using chi-squared tests. 95% confidence intervals were calculated using the Binomial exact method. Logistic regression was used to identify independent predictors of eligibility and vaccination uptake. Total knowledge scores were compared by course, experience, eligibility and uptake using Mann–Whitney and Kruskal–Wallis tests. Multivariate analysis of variance (MANOVA) was used to identify between group differences in the attitude subscales. The five subscales: beliefs, severity, susceptibility, barriers and benefits were included as dependent variables; and gender, discipline, clinical exposure, eligibility and exposure status included as independent variables. The level of statistical significance was set at 5%. Statistical analysis was performed using SPSS, version 16.0 and Stata version 10.1.

3. Results

3.1. Questionnaire response rate

550 questionnaires were distributed and 519 returned (response rate 94.4%). Three questionnaires were excluded because of missing data. 516 usable responses were obtained from future doctors (64.7%), future nurses (15.3%), future physiotherapists (9.5%) and future dentists (10.5%). Participant characteristics are summarised in [Table 1](#).

3.2. Influenza vaccination uptake and comparison with current HCWs

In total, 8.0% (95% CI = 5.9–10.8%) future HCWs were vaccinated against influenza during the 2008–2009 season. In our study, fewer future HCWs were vaccinated compared to uptake amongst current HCWs [8] over the 2007–2008 campaign (8.0% vs. 13.4%; $p < 0.001$), with the exception of nurses. Vaccination uptake for future nurses was significantly higher than the reported uptake for current nurses [7] (12.7% vs. 11.1%; $p < 0.001$).

3.3. Vaccination rates by discipline

Vaccination uptake by discipline was: future nurses 12.7% (95% CI = 6.2–22.0%), future physiotherapists 8.2% (95% CI = 2.3–19.6%), future doctors 8.1% (95% CI = 5.4–11.6%), and future dentists 0% (95% CI = 0–6.6%). 3.9% (95% CI = 1.6–7.8%) of pre-clinical students and 10.2% (95% CI = 7.2–14.0%) clinical students received the influenza vaccine ($\chi^2 = 6.43$, d.f. = 1, $p < 0.001$). There were no statistical differences between males and females in vaccination uptake. In the final multivariable logistic regression model, only level of experience (i.e. clinical status) was significantly associated with uptake.

3.4. Perceived eligibility for influenza vaccination

Overall, more than a third of future HCWs ($n = 195$, 37.6%) (95% CI = 33.4–41.9%) believed they were eligible to receive the influenza vaccine. Of those who did not have the vaccination, 31.7% believed they were eligible to receive it ($\chi^2 = 26.13$, d.f. = 2, $p < 0.001$). There were significant differences between disciplines concerning vaccine eligibility ($\chi^2 = 45.89$, d.f. = 6, $p < 0.001$): 64.6% (51) of future nurses believed they were eligible compared with 44.9% (22) of future physiotherapists and 32.9% (110) of future medics. Only 22.2% (12) of future dentists believed they were eligible to receive

Table 1
Characteristics of respondents^a.

	Medicine	Nursing	Physiotherapy	Dentistry	Overall
Persons, <i>n</i> (%)	334 (64.7)	79 (15.3)	49 (9.5)	54 (10.5)	516
Gender (male), <i>n</i> (%)	118 (35.4)	5 (6.3)	7 (14.3)	12 (22.2)	142 (27.6)
Mean age, <i>n</i> (SD) years	21.4 (2.5)	21.6 (2.7)	19.8 (1.3)	21.2 (1.9)	21.3 (2.4)
Age range	18–32	18–34	18–23	20–32	18–34
Overall chronic illness, <i>n</i> (%)	49 (14.7)	18 (22.7)	6 (12.2)	2 (3.7)	75 (14.4)
Asthma, <i>n</i> (%)	43 (12.9)	14 (17.7)	4 (8.2)	2 (3.7)	63 (12.2)
Diabetes, <i>n</i> (%)	1 (0.3)	2 (2.5)	0 (0)	0 (0)	3 (0.6)
Immune suppressed, <i>n</i> (%)	1 (0.3)	0 (0)	1 (2.0)	0 (0)	2 (0.4)
Other, <i>n</i> (%)	4 (1.2)	2 (2.5)	1 (2.0)	0 (0)	7 (1.4)

^a Internal inconsistencies due to missing values.

the influenza vaccine. Of those who believed they were eligible to receive the influenza vaccine, 38.5% (75) cited individual chronic illness and 10.8% (21) believed they were eligible due their HCW status. Compared to pre-clinical students (27.5%, *n* = 50), more clinical students (43.5%, *n* = 145) believed that they were eligible to receive the influenza vaccine ($\chi^2 = 14.00$, d.f. = 2, *p* < 0.001). When gender, discipline, and level of exposure were considered in a multivariable logistic regression analysis, all three factors were found to be independently associated with eligibility. The odds of males considering they were eligible were 1.82 times greater than females (95% CI (1.18–2.81)). Clinical students were 3.27 times greater than the pre-clinical (95% CI (2.08–5.25)). Medical, nursing and physiotherapists being 2.18: 95% CI (1.08–4.38), 12.5: 95% CI (5.33–29.1) and 6.5: 95% CI (2.57–16.32) times more likely to perceive they were eligible than dentists.

3.5. Knowledge of influenza vaccination

Many future HCWs were able to identify correctly specific knowledge about influenza mortality (77.2%, *n* = 400), its complications (74.4%, *n* = 386), and infectivity (94%, *n* = 486). A Kruskal–Wallis test revealed that total knowledge varied significantly across disciplines, χ^2 (3) = 8.13, *p* < 0.05, with future medics having the lowest scores (median (IQR) 2 (2–3) vs. 3 (2–3)).

A Kruskal–Wallis test did not reveal significant differences in total knowledge between those who believed that they were eli-

gible to receive the influenza vaccine and those who did not, or did not know if they were eligible. Mann–Whitney *U* analyses did not reveal significant differences in total knowledge between pre-clinical and clinical future HCWs, or between those who had and had not been vaccinated.

3.6. Attitudes

Summary statistics for the 5 attitude subscales are presented in Table 2. There was no evidence of significant differences in attitude scores with respect to gender, discipline, clinical exposure, vaccination or eligibility status.

4. Discussion

4.1. Overview of the results

Our findings indicate that influenza vaccine uptake in future HCWs was lower than the reported uptake for current HCWs, and below government targets. Level of exposure to patients (i.e. clinical status) was the only independent determinant of being vaccinated. Male gender, medics, nurses and physiotherapists but not dentists, and level of exposure to patients, were each associated with greater odds of perception of vaccine eligibility. Attitudes towards and knowledge about the influenza vaccination were not associated with vaccination or eligibility status.

Table 2
Attitudes towards influenza and influenza vaccination.

	Beliefs mean (SE), <i>n</i> = 511	Severity mean (SE), <i>n</i> = 514	Susceptibility mean (SE), <i>n</i> = 513	Barriers mean (SE), <i>n</i> = 511	Benefit mean (SE), <i>n</i> = 497	Multivariate <i>p</i> -value ^a
Discipline						0.14
Medicine	12.43 (0.17)	12.69 (0.19)	11.55 (0.19)	8.19 (0.15)	7.79 (0.15)	
Nursing	13.42 (0.34)	13.42 (0.38)	11.39 (0.38)	7.55 (0.31)	8.30 (0.30)	
Physiotherapy	12.30 (0.32)	12.32 (0.37)	10.78 (0.37)	7.90 (0.29)	7.57 (0.29)	
Dentistry	11.96 (0.28)	12.23 (0.32)	10.32 (0.32)	7.83 (0.26)	7.78 (0.25)	
Exposure						0.23
Pre-clinical	12.20 (0.22)	12.53 (0.25)	10.78 (0.25)	7.89 (0.20)	7.78 (0.20)	
Clinical	12.97 (0.17)	12.93 (0.20)	11.53 (0.20)	7.92 (0.16)	7.96 (0.16)	
Gender						0.83
Male	12.59 (0.27)	12.76 (0.31)	10.88 (0.31)	7.74 (0.25)	7.94 (0.24)	
Female	12.62 (0.15)	12.73 (0.17)	11.36 (0.17)	8.01 (0.14)	7.83 (0.13)	
Eligibility						0.53
Yes	13.12 (0.21)	12.96 (0.24)	11.29 (0.24)	7.99 (0.19)	8.14 (0.19)	
No	12.11 (0.24)	12.71 (0.28)	11.14 (0.28)	8.12 (0.22)	7.48 (0.22)	
Don't know	12.14 (0.25)	12.26 (0.29)	10.98 (0.29)	7.37 (0.23)	7.84 (0.23)	
Vaccinated						0.18
Yes	13.30 (0.37)	13.09 (0.42)	11.82 (0.42)	8.58 (0.34)	8.27 (0.33)	
No	12.36 (0.13)	12.62 (0.15)	10.95 (0.15)	7.66 (0.12)	7.73 (0.12)	
Total	12.48 (0.08)	12.71 (0.08)	11.37 (0.09)	7.96 (0.07)	7.63 (0.07)	

^a From MANOVA.

4.2. Factors related to uptake

Previous studies have consistently found that nurses have the lowest vaccination uptake of all healthcare professional groups [7]. These results conflict with our findings that future nurses had the highest uptake. A reason for this may be the differing emphasis upon personal and patient protection between student courses.

As a group, clinical students had a higher uptake than pre-clinical students suggesting that increased time in the workplace may correlate with vaccination uptake. This indicates that promotional workplace campaigns may be beneficial for future HCWs. Interestingly, there was no hierarchy to vaccination uptake as final year clinical students did not have a higher uptake compared to first year clinical students. This may reflect the concept of the Health Belief Model [16], which draws parallels between “behavioural intentions” and “actual behaviour”, noting that intention is an excellent predictor of behaviour. According to this, first year students who are not vaccinated for one year would not be vaccinated the next year despite campaigns. Therefore, establishing regular vaccination as ‘the norm’ for HCWs whilst still in training may ensure that the intention not only becomes an action but also a habit.

Recently published data reports an uptake rate of 40.3% in the West Midlands Strategic Health Authority of pandemic H1N1 vaccine in HCWs [17]. This uptake rate is still below recommended targets although much higher than the seasonal influenza vaccination in HCWs during the 2008–2009 season. This higher uptake may reflect media panic and rising pandemic H1N1 specific mortality. However, pandemic status and mortality rates should not be the only two reasons why HCWs accept vaccination and perhaps repetition of seasonal influenza vaccination may help to increase the likelihood of vaccination in the future.

4.3. Discussion on perceived eligibility for vaccination

Our findings indicate that few HCWs are aware that their HCW status makes them eligible for influenza vaccination. Future nurses had the greatest awareness of eligibility and the highest uptake, whilst future dentists who had the lowest uptake also had the least awareness of eligibility. This is once again supported by the Health Belief Model [16]. The higher perception of eligibility observed in clinical students compared to pre-clinical suggests that patient exposure is an indicator for eligibility as well as uptake itself.

Whilst uptake in current and future HCWs is disappointingly low; uptake in other high-risk groups such as the over 65s remains high, often achieving targets of over 75% [1]. The ‘over 65s’ are subject to massive, nationwide campaigns, involving both primary and secondary care trusts, indicating that campaigns can be an extremely powerful tool in influencing behaviour. De Juanes et al. explain that ‘persons vaccinated in a previous campaign are four to nine times more likely to be vaccinated in future seasons’ [18]. This would suggest that a single successful campaign could positively reinforce behaviour amongst future HCWs during and post-qualification. Currently, individual NHS trusts are required to establish and fund their own vaccination programme; however, evidence suggests that vaccination stations together with reminders are beneficial in improving uptake [11,12,18,19].

4.4. Knowledge of influenza vaccination

Overall, despite good knowledge uptake was low, suggesting that knowledge alone is insufficient in encouraging HCWs to get vaccinated. This suggests the need for promotional campaigns to emphasise directly the importance of vaccination in terms of personal and patient protection and to eliminate misconceptions about the vaccine.

4.5. Attitudes towards influenza vaccination

Our survey tool contained attitude statements related to perceptions of the severity of influenza, susceptibility to it, and the costs and benefits incurred in undertaking the vaccine, consistent with the Health Belief Model. Previous studies using this model have shown significant associations between these elements and vaccination uptake [5,15,20], but we found that knowledge of influenza and attitudes towards vaccination were independent of vaccination status.

It is assumed that current HCWs feel a sense of responsibility towards patients and, therefore, may better understand the importance of vaccination as a benefit to their patients independent of personal protection. Our research tool examined knowledge and attitudes but did not account for student indifference towards vaccination. Students may show good knowledge, consider no real barriers to vaccination but still not receive the vaccination, especially if they know it is not mandatory.

4.6. Limitations

Our study showed that when participants are in a clinical environment, which would increase their workplace knowledge and patient responsibility, vaccine uptake is increased. The reason for this may be that the requirement and availability of the vaccination becomes more apparent. Indeed, *future* nurses showed highest uptake of all the disciplines. It is this group which assumes clinical responsibilities earlier in the course compared to the others. However, all questionnaires were not completed at the same time within the season and *future* nurses were surveyed last (March 2009) giving them more opportunity to receive the vaccine. This extended opportunity may be a confounding factor although since only 12.7% of future nurses showed a positive vaccination status it may have not had much of an effect on participant responses.

5. Recommendations

Responsibility must be encouraged in students from an early stage to promote good ‘health seeking behaviours’ that are vital for personal and patient protection. In order to increase uptake in *future* HCWs, promotional campaigns could be targeted more towards a student audience but need to allow for potential apathy. A targeted national promotional campaign could be implemented, with widened access and routine vaccination supported by a national policy. This could be complemented with vaccination stations in medical and dental schools during influenza seasons. Additionally, influenza vaccination could be implemented as a mandatory requirement on healthcare student Personal Vaccination Records (PVRs).

6. Conclusions

Influenza vaccination uptake in *future* (8.0%) and current HCWs (13.4%) is low, falling significantly short of the government target of 75% [7]. The vaccination of HCWs against influenza is important, offering benefits in terms of personal and patient protection, as well as reducing absenteeism [21]. Low uptake demonstrates the need for effective strategies to improve vaccination coverage amongst HCWs.

Our study identified several reasons for low uptake including unawareness of eligibility and an apparent apathy towards vaccination despite good knowledge. For these reasons promotional campaigns to increase uptake should be targeted specifically towards *future* HCWs allowing for these findings. Responsibility towards patients and self alongside early vaccination should ensure

that vaccination becomes a repeated action leading to a higher uptake when this group becomes professionally qualified.

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Appendix A.

Structured questionnaire

1. Do you believe that you are eligible for the 'flu' vaccine?
2. Have you had the 'flu' vaccine this winter (2008–2009)?
3. Influenza is responsible for 3000 respiratory deaths per year.
4. The main complications of 'flu' are respiratory in nature.
5. 'Flu' is a highly infectious and communicable disease.
6. The 'flu' is a potentially fatal illness.
7. The 'flu' vaccine is not necessary if I am feeling well.
8. I cannot die from the 'flu'.
9. Receiving the 'flu' vaccine is painful.
10. The 'flu' vaccine is important in protecting me from influenza infection.
11. The 'flu' vaccine gives me protection from influenza for life.
12. The side effects of the 'flu' vaccine are severe enough to prevent me getting the 'flu' vaccine.
13. I should have the 'flu' vaccine if I frequently suffer from colds.
14. If I am ill with 'flu' I may take time off work.
15. The 'flu' vaccine is important in reducing the transmission of 'flu' to patients I see.
16. I do not need the 'flu' vaccine because I practise good infection control techniques, e.g. hand washing.
17. Government guidelines recommend 'flu' vaccination in all future HCWs.
18. In my opinion, as a future HCW, I should be eligible for the 'flu' vaccine.

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